Battery cartridge having a recess for detecting misuse and/or recessed terminals.

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Abstract of **EP0572327**

The battery pack has a detection aperture (102, 104, 108) formed along a center line (X-X) of a bottom surface (16) arranged such that the detection aperture is engaged with a convexed portion of a battery charger. Therefore, whether or not the battery pack is properly attached to the battery charger can easily be detected. Further, a battery pack is arranged such that an aperture is formed on an outer surface of the battery pack and an output terminal (38) is inwardly disposed on the aperture. Therefore, damage to the batteries in the battery pack caused by a short-circuit resulting from products made of conductive metal material such as key ring, necklace, chain or the like contacting the respective ends of the output terminals disposed on the outer surface of the battery pack can be prevented. Furthermore, the battery pack is arranged such that an aperture (88) for discharging dust or the like is formed on a bottom portion of a hole into which an electrode is disposed.

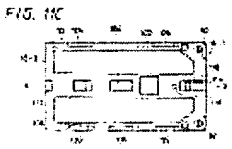
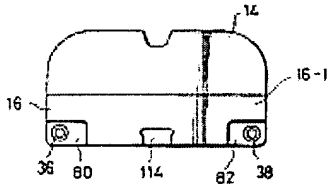


FIG. 13A



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(54) Battery pack having recesses to detect proper attachment of the pack to a battery charger

Batteriepatrone mit Aussparungen zur Kontrolle des richtigen Aufsetzens der Patrone auf ein Batterieladegerät

Cartouche à piles ayant une cavité pour détecter une utilisation erronnée

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Description

Field of the Invention

The present invention relates to a battery cartridge or battery pack having a plurality of batteries accommodated therein for use in a DC (direct current) power supply of electrical machinery and apparatus.

Background of the Invention

An example of a conventional battery cartridge (hereinafter referred to as a battery pack) that has previously been disclosed in Japanese patent application JP-A-4 286 876 (publ. 12 Oct. 1992), and corresponding US Patent US-A-5 249 927 (publ. 28 Sept. 1993) to the same assignee of the present application will be described below.

FIG. 1 of the accompanying drawings shows battery charger 12 with a battery pack 10 attached and FIG. 2 shows an example of such battery charger 12 without a battery pack attached.

As illustrated, the battery charger 12 is a molded product of a plastic material and has a recessed portion 51 onto which the battery pack 10 is attached. The battery charger 12 comprises a primary circuit portion 52 having a power supply transformer or the like and a secondary circuit portion 53 having a rectifying circuit or the like. The battery charger 12 further includes an AC (alternating current) cord 54 having a plug connected to the primary circuit portion 52.

As shown in FIG. 2, the secondary circuit portion 53 includes an adaptor plug 55 from which a DC power is supplied, first and second terminals 56, 57 from which a charging power is supplied and a third terminal 58 from which a temperature detecting signal is input to the battery charger 12. The adaptor plug 55 is provided so that the electrical machinery and apparatus can be operated by directly utilizing a DC power supplied from the AC power supply instead of the battery pack 10.

The three terminals 56, 57 and 58 are formed as leaf springs so that they can be deformed flexibly. A spring constant of the third terminal 58 is selected to be substantially 2/3 of those of the first and second terminals 56, 57. The first, second and third terminals 56, 57, 58 are assembled into a molded plate 60 and the molded plate 60 is disposed on the bottom surface of the recessed portion 51. The molded plate 60 is colored a in proper color such as blue or the like, which is different from the color (black) of the case 59 of the battery pack 10.

The secondary circuit portion 53 includes a control circuit (not shown). The control circuit is operated to control the charging of the battery within the battery pack 10 and controls the charging state of the battery on the basis of a so-called-$\blacktriangle$V charging completion method in which a voltage between the first and second terminals 56, 57 is progressively increased by the start of the charging and the charging is ended when the voltage is lowered a little after the voltage had reached the peak value.

The aforesaid control circuit detects the temperature of a battery that is being charged on the basis of a temperature detecting signal from a temperature detecting element provided on the bottom surface of the battery pack 10. When such detected temperature of the battery exceeds a predetermined value, the control circuit interrupts a charging current supplied from the first and second terminals 56, 57 to the battery thereby to disable the battery charger 12 from charging the battery.

As shown in FIG. 1, the battery pack 10 includes a casing 18 that comprises an upper casing 14 and a bottom casing 16. The casing 18 is so arranged as to accommodate therein a plurality of batteries.

FIGS. 3A and 3B show the battery pack 10 with cylindrical batteries 21 through 25 accommodated within the battery pack 10. More specifically, FIG. 3A is a diagram showing the inside of the battery pack 10 with the bottom casing 16 removed. FIG. 3B is a cross-sectional view taken along the line III - III in FIG. 3A.

The batteries 21 through 25 may be nickel-hydrogen secondary batteries and are arranged in parallel to one another as shown in FIGS. 3A and 3B. The electrodes of the batteries 21 to 25 are connected by means of conductive plates 32. Hence, the five batteries 21 to 25 are constructed as a combination battery 27 in which the batteries 21 to 25 are electrically connected in series. An insulating sheet 34 is disposed between the electrodes of the batteries 21 to 25 and the conductive plates 32.

The combination battery 27 includes first and second electrodes 36 and 38 of positive and negative polarities for effecting the charging and discharging. A temperature detecting element 42 such as a thermistor or the like and a breaker (not shown) are disposed under the two electrodes 36, 38. The first and second electrodes 36, 38, the temperature detecting element 42 and the breaker (not shown), etc., are supported by a molded member 44 disposed between the two batteries 21 and 22.

The electrodes 36, 38 of the combination battery 27 constitute output terminals of the battery pack 10. Hence, the electrodes 36, 38 will be referred to as output terminals 36, 38, if necessary.

A third electrode 40 that outputs a temperature detecting signal is further disposed under the battery 21. The third electrode 40 is formed as a thin plate that constitutes a leaf spring. The third electrode 40 may be directly bonded to the battery 21 by an adhesive or attached to the molded member 44.

Two lead wires 42A and 42B are connected to the temperature detecting element 42. The temperature detecting element 42 is connected to the first electrode 36 by means of the first lead wire 42A, and the temperature detecting element 42 is connected to the third electrode 40 by means of the second lead wire 42B.

The combination battery 27 and the three electrodes 36, 38 and 40 are disposed so as to contact with the inner surface of the upper casing 14.

FIG. 4 shows a configuration of the bottom surface of the casing 18, i.e., the outer surface of the bottom casing 16. The bottom casing 16 has on its outer surface eleven recessed portions 16A through 16K formed and three through-holes 16a, 16b and 16c bored therethrough. Of the three through-holes 16a, 16b and 16c, the two through-holes 16a, 16b are bored through the recessed portions 16D and 16E, respectively.

The three through-holes 16a, 16b, 16c are bored through the outer surface of the bottom casing 16 at three positions corresponding to the three electrodes 36, 38 and 40 of the battery pack 10. Therefore, when the upper casing 14 is covered with the bottom casing 16 to form the casing 18 and the batteries 21 to 25 are accommodated within the casing 18, the three electrodes 36, 38, 40 are exposed from the corresponding three throughholes 16a, 16b, 16c, respectively.

The eight recessed portions 16C through 16J and the two through-holes 16a, 16b are disposed in association with spacings 28A through 28D of the batteries 21 to 25.

As shown in FIG. 4, on the outer surface of the bottom casing 16, symbols +, - and ⊥ encircled by the symbol o, which are adjacent to the three electrodes 36, 38, 40, are formed. These symbols are formed by forming concavities and convexities on the form of the bottom casing 16 when the plastic material is molded.

The bottom casing 16 is colored in black and the portion within a dashed line 20 encircling the three through-holes 16a, 16b, 16c is colored in another color such as blue.

On the bottom surface of the recessed portion 51 of one battery charger 12, convexes portions 61A, 61B, 61C are formed. The convex portions 61A, 61B, 61C are disposed so as to be engaged with the corresponding recessed portions 16I, 16G, 16H of the battery pack 10.

Of such recessed portions 16I, 16G and 16H, the outside recessed portions 16I, 16G are referred to as detection apertures and the inside larger recessed portion 16H is referred to as a locking aperture. The detection apertures 16I, 16G function to detect whether or not the battery pack 10 is properly attached to the battery charger 12 or the like.

When the battery pack 10 is properly attached to the battery charger 12, the two convexed portions 61A, 61B are properly inserted into the detection apertures 16I, 16G, respectively. Conversely, when the battery pack 10 is not properly attached to the battery charger 12, the two convexed portions 61A, 61B are not inserted into the corresponding recessed portions 16I, 16G and the bottom surface of the battery pack 10 is caused to rise from the bottom surface of the recessed portion 51 of the battery charger 12.

The locking aperture 16H functions to support the battery pack 10 so that the battery pack 10 attached to the battery charger 12 is prevented from being moved uselessly during charging.

When the proper battery pack 10 is attached to the battery charger 12, the three electrodes 36, 38, 40 of the combination battery 27 exposed from the through-holes 16a, 16b, 16c of the bottom casing 16 are respectively brought in contact with the three terminals 56, 57, 58 of the battery charger 12.

Since either of the three electrodes 36, 38, 40 and the three terminals 56, 57, 58 are formed of the members that can be deformed with flexibility, e.g., leaf springs as described above, both of the three electrodes 36, 38, 40 and the three terminals 56, 57, 58 can be reliably brought in contact with one another by spring force of such resilient members. As described above, the spring constant of the third terminal 58 is selected to be small as compared with those of other remaining terminals 56 and 57 so that, even when the battery pack 10 without the third electrode 58 is attached to the battery charger 12, the bottom surface of the battery pack 10 can be protected from being damaged.

In the aforesaid example of the prior art, the bottom casing 16 of the battery pack 10 includes the detection apertures 16I, 16G and whether the battery pack 10 can be properly attached to the battery charger 12 is determined by detecting whether or not the convexed portions 61A, 61B on the bottom surface of the recessed portion 51 of the battery charger 12 are properly engaged with the detection apertures 16I, 16G. This arrangement can be can be utilized not only between the battery pack 10 and the battery charger 12 but also between the battery pack 10 and electrical machinery and apparatus that utilizes the battery pack 10 as a power source.

In the aforesaid battery pack 10, i.e., the output terminals 36, 38 are exposed from the apertures 16a, 16b.

When the battery pack 10 is not properly attached to the battery charger 12, the battery pack 10 is caused to rise from the battery charger 12 by an amount corresponding to the height of the convexed portions 61A, 61B and then inclines. If an inclination angle of the battery pack 10 is large, whether or not the battery pack 10 is properly attached to the battery charger 12 can easily be detected. If on the other hand, the inclination angle is small, then it becomes more difficult to detect whether or not the battery pack 10 is properly attached to the battery charger 12.

In order to increase the inclination angle, the heights of the convexed portions 61A, 61B of the battery charger 12 must be increased and the depths of the detection apertures 16I, 16G of the battery pack 10 must be increased, which, however, makes the molding treatment of the battery charger 12 and the bottom casing 16 impossible.

To increase the inclination angle of the battery pack 10 without changing the heights of the convexed portions 61A, 61B of the battery charger 12, the convexed portions 61A, 61B of the battery charger 12 and the de-

tection apertures 16I, 16G of the battery pack 10 must be formed at the positions nearer to the center position.

In the aforesaid example of the prior art, as shown in FIG. 4, the detection apertures 16I, 16G are bored through the bottom casing 16 of the battery pack 10 side by side at one of its side portions and are not formed at the center thereof.

Further, the battery pack 10 has mounted thereon an identification marker (not shown) that indicates the condition that the battery was already utilized and charged. Such identification marker is disposed at a front end portion 16-1 (see FIG. 3B) of the bottom casing 16 of the battery pack 10 so that the dimension of the battery pack 10 is increased in its longitudinal direction by an amount corresponding to the protruded portion of the identification marker.

FIGS. 5A, 5B and FIGS. 6A, 6B show other examples of the conventional battery pack 10. In these examples of the conventional battery pack 10, the electrodes 36, 38, i.e., output terminals 36, 38, are disposed at positions different from those of the example shown in FIG. 4. However, the electrodes 36, 38, i.e., output terminals 36, 38, are both exposed on the outer surface of the casing 18. Thus, there is the risk that the batteries within the battery pack 10 will be damaged when the electrodes 36, 38, i.e., output terminals 36, 38, are short-circuited by conductive metal products such as a key ring, a necklace, a chain or the like.

It is another problem that dust or the like may collect on the electrodes which could result in the electrical connection between the electrodes and the connection terminals of the battery charger or electrical machinery and apparatus to fail.

Objects and Summary of the Invention

Accordingly, it is an object of the present invention to provide an improved battery pack in which some at least of the aforesaid shortcomings and disadvantages encountered with the prior art can be eliminated.

More specifically, it is an object of the present invention to provide a battery pack in which it can be easily determined whether or not a battery pack is properly attached to a battery charger.

It is another object of the present invention to provide a battery pack having an identification marker formed thereon without sacrificing the volume of the inside of the casing.

These and other objects are met by the battery pack defined in the appended claims.

The various features and advantages of the present invention will become apparent from the following detailed description of illustrative embodiments thereof to be read in conjunction with the accompanying drawings, in which like reference numerals are used to identify the same or similar parts in the several views.

Brief Description of the Drawings

FIG. 1 is a perspective view illustrative of an example of a conventional battery pack attached to a battery charger;

FIG. 2 is a perspective view illustrative of an example of a conventional battery charger;

FIG. 3A is a diagram used to explain an example of the conventional battery pack;

FIG. 3B is a cross-sectional view taken along the line III - III in FIG. 3A;

FIG. 4 is a bottom view illustrative of an example of the conventional battery pack;

FIGS. 5A, 5B and FIGS. 6A, 6B are perspective views illustrative of examples of conventional battery packs, respectively;

FIG. 7 is a perspective view illustrative of a battery pack used in an embodiment of the present invention;

FIG. 8A is a fragmentary cross-sectional view illustrative of a front end portion of a bottom casing of the battery pack shown in FIG. 7;

FIG. 8B is a front view thereof;

FIGS. 9A and 9B are schematic diagrams showing examples of connection terminals that are inserted into holes of the battery pack shown in FIG. 7, respectively;

FIG. 10 is a perspective view illustrative of an appearance of a battery pack according to a first embodiment of the present invention;

FIG. 11A is a plan view illustrative of a casing of the battery pack shown in FIG. 10;

FIG. 11B is a side view thereof;

FIG. 11C is a bottom view thereof;

FIG. 12 is a cross-sectional view taken along the line XII - XII of FIG. 10;

FIG. 13A is an end view illustrative of a front end portion of the battery pack shown in FIG. 10;

FIG. 13B is a cross-sectional view taken along the line XIII - XIII in FIG. 10;

FIG. 14A is a side elevation view illustrative of an identification marker used in an embodiment of the present invention

FIG. 14B is a plan view thereof;

FIGS. 15A and 15B are diagrams showing the condition that an identification marker formed on a battery pack is in use, respectively;

FIG. 16 is a bottom view illustrative of the battery pack according to a second embodiment of the present invention;

FIG. 17A is a perspective view illustrative of the battery pack according to a third embodiment of the present invention;

FIG. 17B is a fragmentary cross-sectional view of a main portion of the battery pack according to the third embodiment of the present invention;

FIG. 18A is a perspective view illustrative of the battery pack according to a fourth embodiment of the

present invention;

FIG. 18B is a fragmentary cross-sectional view of the battery pack according to the fourth embodiment of the present invention;

FIG. 19A is a fragmentary cross-sectional view illustrative of a front end portion of a bottom casing of the battery pack; FIG. 19B is a front view thereof;

FIG. 20A is a fragmentary cross-sectional view illustrative of a front end portion of a bottom casing of the battery pack according to another variant; and

FIG. 20B is a front view thereof.

Detailed Description of the Preferred Embodiments

Referring to the drawings in detail, and initially to FIGS. 7 to 16, a battery pack according to a first embodiment of the present invention will be described below. In FIGS. 7 to 16, like parts corresponding to those of FIGS. 1 to 4 are marked with the same references and therefore need not be described in detail.

FIG. 7 is a perspective view illustrative of an appearance of the battery pack 10 of the instant invention. As shown in FIG. 7, the battery pack 10 includes the casing 18 which comprises the upper-casing 14 and the bottom casing 16.

In this example, cylindrical batteries are disposed in two rows within the battery pack 10 and four batteries are accommodated within the battery pack 10 in total. Such four batteries may be electrically connected in series to form a combination battery.

Around the bottom surface of the battery pack 10, there are formed holes 120, 122, 124, 126 (only the holes 124, 126 are shown in FIG. 7). These holes 120 to 126 are adapted to receive corresponding protruded portions formed on a battery accommodating portion when the battery pack 10 is attached to the battery accommodating portion of electrical machinery and apparatus.

As shown in FIG. 7, concave portions 80, 82 are formed on the front end portion 16-1 of the bottom casing 16 and the first and second electrodes 36, 38 of the combination battery are disposed at the bottom surfaces of the concave portions 80, 82.

The electrodes 36, 38 function as charging electrodes when the battery pack 10 is attached to the battery charger to charge the batteries. Also, the electrodes 36, 38 function as power supply electrodes when the battery pack 10 is attached to the electrical machinery and apparatus to supply power.

FIGS. 8A and 8B show an example of a structure of the first electrode 36 disposed on the concave portion 80, respectively. FIG. 8A is a fragmentary cross-sectional view illustrative of the front end portion 16-1 of the bottom casing 16, and FIG. 8B is a front view thereof. As illustrated, a hole 84 of substantially circular configuration is formed through the bottom surface of the concave portion 80. The first electrode 36 is disposed along the inner surface of the hole 84. The second electrode 38 that is disposed on the concave portion 82 may be arranged similarly as shown in FIGS. 8A and 8B.

FIGS. 9A and 9B show an example of connection terminals 90 that are coupled to the electrodes 36, 38 of the battery pack 10. The connection terminals 90 are disposed on the battery accommodating portion of the battery charger or electrical machinery and apparatus. The connection terminal 90 has a columnar configuration corresponding to the hole of the battery pack 10, and two springs 92A, 92B are disposed on the columnar surface thereof.

FIG. 10 is a perspective view illustrative of an appearance of the battery pack 10 according to the first embodiment of the present invention. As shown in FIG. 10, the battery pack 10 includes a casing 18 which comprises an upper casing 14 and a bottom casing 16.

FIGS. 11A, 11B and 11C show in more detail the casing 18 of the battery pack 10. FIG. 11A is a plan view thereof, FIG. 11B is a side view thereof and FIG. 11C is a bottom view thereof. FIG. 12 is a cross-sectional view taken along the line XII - XII of FIG. 10. FIG. 13A is an end view illustrative of the front end portion of the battery pack 10 and FIG. 13B is a cross-sectional view taken along the line XIII - XIII of FIG. 10.

As shown in FIG. 13B, according to this embodiment, the cylindrical batteries are disposed in two rows within the battery pack 10 and four batteries are accommodated within the battery pack 10 in total. Similar to the example of the prior art, the four batteries may be electrically connected in series to form a combination battery.

Referring to FIGS. 11A to 11C and FIG. 12, the bottom casing 16 of the battery pack 10 has on its bottom surface recessed portions 102, 104, 108, 112 formed along a center line X - X and a recessed portion 106 formed along the side portion thereof. The recessed portions 102, 104, 106 are used as detection apertures and the recessed portions 108, 112 are used as locking apertures.

Whether or not the battery pack 10 is properly attached to the battery charger can be detected by the detection apertures 102, 104, 106. The battery pack 10 that is attached to the battery charger can be supported at that position by the locking apertures 108, 112.

Holes 120, 122, 124 and 126, each having a rib, are formed around the bottom surface of the bottom casing 16. The holes 120 to 126 are adapted to receive corresponding protruded portions formed on the battery accommodating portion when the battery pack 10 is attached to the battery accommodating portion of the electrical machinery and apparatus.

Concave portions 80, 82 are formed on the front end portion 16-1 of the bottom casing 16. First and second electrodes 36, 38 of the combination battery are disposed on the bottom surfaces of the concave portions 80, 82 as shown in FIG. 13A.

The electrodes 36, 38 function as charging electrodes when the battery pack 10 is attached to the bat-

tery charger to charge the batteries. Also, the electrodes 36, 38 function as power supply electrodes when the battery pack 10 is attached to the electrical machinery and apparatus as a power source.

According to this embodiment, the detection apertures 102, 104 are formed on the bottom surface of the bottom casing 16 along the center line X - X and also at its substantially central portion so that, when the battery pack 10 is not properly attached to the battery charger, the battery pack 10 is considerably inclined by the protrusions (not shown) formed on the battery charger. Thus, there is the advantage that whether or not the battery pack 10 is properly attached to the battery charger can easily be detected.

Further, since the detection apertures 102, 104 are formed between the four batteries that are disposed in two rows, the battery pack 10 need not be increased in size even though the detection apertures 102, 104 are formed.

The front end portion of the bottom casing 16 has a marker formed along the center line X - X. The marker functions to determine whether or not the battery pack 10 was already charged or whether or not the battery pack 10 was finished in use.

FIG. 14A is a side elevation view of the marker, and FIG. 14B is a plan view thereof. As shown in FIGS. 14A and 14B,the marker comprises a concave portion 114 formed along the center line X - X (see FIG. 11C), a slider 118 disposed within the concave portion 114 so that it can be slidably moved therein, and an aperture 116 formed adjacent to the concave portion 114.

The slider 118 includes a plate portion 118A of substantially rectangular configuration and a protruded portion 118B disposed at the top of the plate portion 118A. The respective side portions of the plate portion 118A are in engagement with grooves 114A formed along the wall surfaces of the concave portion 114 so that the slider 118 can be slid along the center line X - X within the concave portion 114.

The concave portion 114 has on its rear portion formed a hole 114B to receive the plate portion 118A of the slider 118. When the slider 118 is moved inwardly along the center line X - X, the plate portion 118A is accommodated into the hole 114B.

A part of the lower side surface of the plate portion 118A of the slider 118 is exposed by the aperture 116 so that, if the lower side surface of the plate portion 118A is marked with a proper symbol or colored in proper color and the slider 118 is slid along the center line X - X, then the above-mentioned symbol or color can be visually confirmed through the aperture 116.

Even when the aperture 116 is not provided, if the slider 118 is moved outwardly along the center line X - X, then the plate portion 118A is ejected from the hole 114B of the concave portion 114 and the lower surface thereof is exposed so that such symbol or color can be visually confirmed.

The marker according to this embodiment is arranged as described above so that the identification mark on the slider 118 can be visually confirmed by slidably moving the slider 118. Thus, the user can know that the batteries in the battery pack 10 were already charged or finished in use.

FIGS. 15A and 15B show the condition that the marker formed on the battery pack 10 is in use. More specifically, FIG. 15A shows the case that the battery pack 10 is attached to a battery accommodating portion 90 of electrical machinery and apparatus, and FIG. 15B shows the case that the battery pack 10 is attached to a battery charger 92.

In the example shown in FIG. 15A, the battery accommodating portion 90 of electrical machinery and apparatus includes a protrusion 90A so that, when the battery pack 10 is moved in the arrow L direction while it is in contact with the bottom surface of the battery accommodating portion 90, the protrusion 90A is engaged with the protruded portion 118B of the slider 118, thereby the slider 118 being pushed inwardly. Therefore, when the slider 118 is moved inwardly, the identification mark formed on the lower surface of the plate portion 118A, provides a proper identification symbol representative of the fact that the batteries in the battery pack 10 were finished in use which can be seen visually.

In the example shown in FIG. 15B, the battery charger 92 includes on its bottom surface an engagement member 94 that is upwardly spring-biased by a spring 94A, for example. The engagement member 94 has on its top formed an inclined surface.

Accordingly, if the battery pack 10 is attached to the battery charger 92 in the direction shown by an arrow L in FIG. 15B while it is in contact with the bottom surface of the battery charger 92, then the protruded portion 118B of the slider 118 is engaged with the engagement member 94, thereby moving the engagement member 94 downwardly.

If the battery pack 10 is ejected from the battery charger 92 in the arrow R direction in FIG. 15B after the charging was ended, the protruded portion 118B of the slider 118 is engaged with the engagement member 94 so that the slider 118 is withdrawn outwardly. Therefore, when the slider 118 is moved outwardly, the identifying symbol formed on the lower surface of the plate portion 118A, e.g., a proper identification symbol representing that the charging of batteries is finished, can be confirmed visually.

The slider 118 may be arranged so that the user can move the slider 118 manually. In such case, when the user moves the slider 118 with fingers, the identification symbol that the batteries were finished in use or that the batteries were already charged can be displayed.

Since the identification marker that determines that the batteries were finished in use or that they were already charged is formed on the bottom casing 16 as described above, increasing the battery pack 10 in size in its longitudinal direction can be avoided.

FIG. 16 shows the battery pack according to a sec-

ond embodiment of the present invention. In this embodiment, as shown in FIG. 16, a detection aperture 110 is formed along the center line X - X. The detection aperture 110 has a width smaller than that of the adjacent locking aperture 108. That is, the width of the detection aperture 110 in the direction perpendicular to the center line X - X is smaller than the width of the locking aperture 108.

When the battery pack 10 is attached to the battery charger or the battery pack accommodating portion of electrical machinery and apparatus, a lock pin (not shown) whose size is matched to the locking aperture 108 is engaged with the locking aperture 108. If the dimension of the detection aperture 110 is larger than that of the locking aperture 108, then the lock pin may engage with the detection aperture 110 before it engages with the locking aperture 108.

Therefore, if the dimension of the detection aperture 110 is selected to be smaller than that of the locking aperture 108, then the lock pin, which should engage with the locking aperture 108, can be prevented from inadvertently engaging with the detection aperture 110.

Furthermore, as shown in FIG. 16, the battery pack 10 includes proper information elements 130, 132. The information elements 130, 132 may include a detector for detecting a temperature of battery, a voltage detector for detecting a remaining capacity of battery and an identifying apparatus for identifying the types of the batteries.

One of the information elements 130, 132 may be the temperature detecting element 42 as earlier noted in the example of the prior art. In such case, the third terminal 40 (see FIGS. 3A, 3B) from which the temperature detection signal of the temperature detection element 42 is output may be disposed at the proper position.

According to the present invention, whether or not the battery pack 10 is properly attached to the battery charger can easily be detected.

According to the present invention, whether or not the battery pack 10 is properly attached to the battery accommodating portion of electrical machinery and apparatus can easily be detected.

Further, according to the present invention, detection apertures can be formed on the bottom surface of the battery pack without increasing the dimensions of the battery pack.

Furthermore, according to the present invention, an identification marker that is used to determine whether the batteries were finished in use or already charged can be provided without increasing the dimension of the battery pack 10.

FIGS. 17A, 17B and FIGS. 18A, 18B show battery packs according to third and fourth embodiments of the present invention. In the third and fourth embodiments of the present invention, the electrodes 36, 38, i.e., output terminals 36, 38, are disposed on the front end portion 16-1 of the bottom casing 16 and the concave portions 80, 82 are not formed, unlike the embodiment shown in FIG. 7.

As illustrated, apertures 172, 174 are formed, through the front end portion 16-1 of the bottom casing 16, and the electrodes 36, 38 are disposed at the position very slightly spaced from the apertures 172, 174 inwardly. The electrodes 36, 38 are shaped specifically so that they can receive and come in reliable contact with the connection terminals 90 of the corresponding battery charger or battery accommodating portion of electrical machinery and apparatus.

In the third embodiment shown in FIGS. 17A, 17B, the apertures 172, 174 of the bottom casing 16 are rectangular in shape so as to accept the connection terminals 90 which are rectangular in cross section. The electrodes 36, 38 are made of thin plate materials which are curved in a U-shape. Contact portions 36A, 38A whose cross sections are small are formed at the entrances of the electrodes 36, 38.

In the fourth embodiment shown in FIGS. 18A, 18B, the apertures 172, 174 of the bottom casing 16 are circular in shape so as to accept the connection terminals 90 which are circular in cross section. The electrodes 36, 38 are made of cylindrical thin plate members and have on their side surfaces slits 36B, 38B extended in the axial directions. Also, the contact portions 36A, 38A whose cross sections are small are formed at the entrances of the electrodes 36, 38.

As described above, the output terminals of the battery pack, i.e., the electrodes 36, 38 are disposed within the apertures or concave portions formed on the outer surface of the battery pack 10. Therefore, short-circuiting the two output terminals 36, 38 by contact with products made of conductive metal material such as key ring, necklace, chain or the like when the output terminals 36, 38 can be prevented.

According to the present invention, since the output terminals, i.e., electrodes 36, 38 are disposed in the inside of the hole 84 or apertures 172, 174 formed within the battery pack 10, the output terminals, i.e., electrodes 36, 38, contact with products made of conductive metal materials such as key ring, necklace, chain or the like can be prevented.

Furthermore, according to the present invention, since the output terminals, i.e., electrodes 36, 38 of the battery pack 10 can be protected from coming into contact with products made of conductive metal materials such as key ring, necklace, chain or the like, damage to the batteries accommodated within the battery pack 10 resulting from a short-circuit can be prevented.

The battery pack will be further described with reference to FIGS. 19A, 19B and FIGS. 20A, 20B. In FIGS. 19A, 19B and FIGS. 20A, 20B, like parts corresponding to those of FIG. 7, FIGS. 8A, 8B and FIGS. 9A, 9B are marked with the same references and therefore need not be described in detail.

In the example shown in FIG. 7 and FIGS. 8A, 8B, the hole 84 bored through the concave portion 80 in-

cludes a closed bottom portion and the hole 84 tends to collect dust or the like. If the hole 84 collects dusts or the like, then an electrical connection failure frequently occurs between the electrodes 36, 38 of the battery pack 10 and the connection terminals 90 of the battery charger or electrical machinery and apparatus.

FIGS. 19A, 19B show in detail the front end portion of the battery pack 10. FIGS. 19A, 19B correspond to FIGS. 8A, 8B. FIG. 19A is a fragmentary cross-sectional view illustrative of the front end portion 16-1 of the bottom casing 16 and FIG. 19B is a front view thereof.

As illustrated, the concave portions 80, 82 are formed on the front end portion 16-1 of the bottom casing 16. Holes 84, 86 are respectively formed on the concave portions 80, 82. The output terminals of the combination battery, i.e., first and second electrodes 36, 38 are disposed on the bottom surfaces of the holes 84, 86.

The electrodes 36, 38 function as the charging electrodes when the battery pack 10 is attached to the battery charger for charging the batteries. In contrast, the electrodes 36, 38 function as the power supply electrodes used when the battery pack 10 is attached to the electrical machinery and apparatus as the power supply.

FIGS. 19A, 19B show examples of structures of one side of the holes 84, 86 respectively formed on the concave portions 80, 82 and the first and second electrodes 36, 38 respectively disposed on the holes 84, 86, i.e., the first hole 84 and the first electrode 36 disposed in the first hole 84. The second hole 86 and the second electrode 38 disposed in the second hole 86 may be arranged similarly to the first hole 84 and the first electrode 36 disposed in the first hole 84 shown in FIGS. 19A, 19B.

As shown in FIGS. 19A, 19B, the concave portion 80 has on its bottom surface formed the hole 84 of substantially circular configuration and the first electrode 36 is disposed along the inner surface of the first hole 84.

Comparison of FIGS. 19A, 19B with FIGS. 8A, 8B reveals that, in this embodiment, an aperture 88 for discharging dusts or the like is formed on the bottom portion of the hole 84 and that the aperture 88 is elongated from the bottom portion of the hole 84 to the bottom surface 16-3 of the bottom casing 16.

Therefore, the hole 84 and the aperture 88 constitute a through-hole that is extended from the front end portion 16-1 to the bottom surface 16-3 of the bottom casing 16. Thus, even when dust or the like enter the hole 84, such dust or the like can be discharged to the outside of the battery pack 10 through the aperture 88 from the bottom of the hole 84.

FIGS. 20A, 20B show the battery pack 10 according to another variant, in which the aperture 88 bored through the bottom portion of the hole 84 is inwardly extended to the battery pack 10. Therefore, by means of the aperture 88, the bottom portion of the hole 84 is coupled to the inside of the casing 18 but is not coupled to the outside of the casing 18. In this variant, dust or the like entered the hole 84 are inwardly discharged to the battery pack 10 through the aperture 88 from the bottom portion of the hole 84.

Since dust or the like entered the hole 84 are discharged to the outside of the hole 84 through the aperture 88 from the bottom portion of the hole 84, accumulation of dust or the like in the bottom portion of the hole 84 can be avoided. Incidentally, as shown in FIGS. 19A, 19B, it is preferred that the aperture 88 for discharging dust or the like is formed at the central portion of the bottom portion of the hole 84 and the outside surface of the discharging aperture 88 may be formed as a smoothly-curved surface by a chamfer treatment. Thus, even when dust or the like enter the bottom portion of the hole 84, if the connection terminal 90 shown in FIGS. 9A, 9B is inserted into the hole 84, then dusts or the like are pushed by the connection terminal 90 and can be discharged to the outside from the aperture 88 by force.

Since dust or the like having entered the hole 84 formed in the battery pack 10 to dispose therein the electrode is discharged from the discharging aperture 88 bored though the aperture 84, advantageously the accumulation of dust or the like in the bottom portion of the hole 84 can be prevented.

Furthermore, since the accumulation of dust or the like in the hole 84 formed in the battery pack 10 to dispose therein the electrode can be prevented, advantageously an electrical connection failure resulting from the accumulation of dusts or the like on the hole 84 can be avoided.

Claims

1. A battery pack (10) having battery means accommodated therein, and adapted to cooperate with a battery charger (12) or electrical machinery or apparatus utilising the battery pack as a power source, said battery pack comprising:

   a casing (14, 16) for accommodating said battery means therein;
   detection aperture means (102, 104) formed along a center line (X-X) of a bottom surface of the casing, said bottom surface being defined as the surface by which said battery pack confronts a battery pack accommodating portion of said battery charger or electrical machinery or apparatus, said detection aperture means being adapted to receive corresponding protruded portions formed on said battery pack accommodating portion.

2. A battery pack (10) according to claim 1, further comprising a recessed portion (106) forming an additional detection aperture at a side portion of said casing (14, 16), said additional detection aperture being also adapted to receive a corresponding protruded portion formed on said battery pack accommodating portion of said battery charger or electri-

cal machinery or apparatus.

3. The battery pack according to claim 1 or 2, further comprising a locking aperture (108) formed adjacent said detection aperture means (102, 104) and having a width dimension extending in a direction perpendicular to said center line (X-X), and wherein said detection aperture means is smaller than said locking aperture.

4. The battery pack according to any one of claims 1 to 3, wherein columnar batteries are accommodated in two rows in said casing (14, 16) and said detection aperture means (102, 104) is disposed between the two rows of batteries along said center line (X-X) of said bottom surface.

5. The battery pack according to any one of claims 1 to 4, further comprising information elements (130, 132) disposed along said center line (X-X).

6. The battery pack according to claim 5, wherein said information elements (130, 132) include a temperature detector and a voltage detector for detecting the remaining capacity of said battery.

7. The battery pack according to any one of claims 1 to 6, further comprising an identification marker (118A) disposed along said center line (X-X) of the bottom surface for indicating whether or not the battery pack has been accommodated in an adapted electrical apparatus since being inserted in a battery charger, thereby providing an indication of whether said battery pack is in the course of use or not since the battery was charged.

8. The battery pack according to claim 7, wherein said identification marker includes a slidable slider (118) which has a protruded portion (118A).

9. The battery pack according to any one of claims 1 to 8, further comprising a plurality of electrodes (36, 38) formed in said bottom portion of said casing for electrical connection with said battery, said electrodes functioning as charging electrodes when said battery pack is connected to a battery charger and said electrodes functioning as power supply electrodes when said battery pack is connected to an electrical apparatus; and wherein

said detection aperture means (102, 104) provides a means for detecting when said pack is properly positioned in a battery charger.

Patentansprüche

1. Batteriepack (10) mit darin enthaltenen Batterien, der geeignet ist, mit einem Batterieladegerät (12) oder mit elektrischen Maschinen oder Geräten zusammenzuwirken, die den Batteriepack als Stromquelle benutzen, wobei dieser Batteriepack aufweist:

   - ein Gehäuse (14, 16) zur Aufnahme der genannten Batterien darin,
   - Erfassungsöffnungen (102, 104), die entlang einer Mittellinie (X-X) einer Unterseite des Gehäuses ausgeführt sind, wobei die genannte Unterseite als die Oberfläche des genannten Batteriepacks bestimmt ist, mit der dieses auf einen Batteriepack-Aufnahmeabschnitt des genannten Batterieladegeräts oder elektrischen Geräts oder Maschine zu liegen kommt, wobei die genannten Erfassungsöffnungen geeignet sind, entsprechende vorspringende Abschnitte aufzunehmen, die an dem genannten Batteriepack-Aufnahmeabschnitt ausgeführt sind.

2. Batteriepack (10) nach Anspruch 1, der weiterhin eine Vertiefung (106) aufweist, die an einer Stelle an der Seite des Gehäuses (14, 16) eine zusätzliche Erfassungsöffnung bildet, wobei diese zusätzliche Erfassungsöffnung ebenfalls geeignet ist, einen entsprechenden vorspringenden Abschnitt aufzunehmen, der an dem genannten Batteriepack-Aufnahmeabschnitt des genannten Batterieladegeräts oder elektrischen Geräts oder Maschine ausgeführt ist.

3. Batteriepack nach Anspruch 1 oder 2, der weiterhin eine Verriegelungsöflhung (108) aufweist, die angrenzend an die genannten Erfassungsöffnungen (102, 104) ausgeführt ist und mit ihrer Breitendimension senkrecht zu der genannten Mittellinie (X-X) verläuft, und wobei die genannten Erfassungsöffnungen kleiner sind als die genannte Verriegelungsöffnung.

4. Batteriepack nach einem der Ansprüche 1 bis 3, bei dem in dem genannten Gehäuse (14, 16) in zwei Reihen zylindrische Batterien sitzen und die genannten Erfassungsöffnungen (102, 104) zwischen den beiden Batteriereihen entlang der Mittellinie (X-X) der genannten Unterseite angeordnet sind.

5. Batteriepack nach einem der Ansprüche 1 bis 4, der weiterhin Informationselemente (130, 132) aufweist, die entlang der Mittellinie (X-X) angeordnet sind.

6. Batteriepack nach Anspruch 5, bei dem die genannten Informationselemente (130, 132) einen Temperaturfühler und ein Voltmeter zur Messung der verbleibenden Kapazität dieser Batterie umfaßt.

7. Batteriepack nach einem der Ansprüche 1 bis 6, der weiterhin eine Identifikationsmarkierung (118A) aufweist, die entlang der Mittellinie (X-X) der Unterseite angeordnet ist, um anzuzeigen, ob der Batteriepack in ein geeignetes elektrisches Gerät eingelegt wurde oder nicht, seitdem er in einem Batterieladegerät war, womit angezeigt wird, ob der Batteriepack in Gebrauch ist oder nicht, seit die Batterie geladen wurde.

8. Batteriepack nach Anspruch 7, bei dem die genannte Identifikationsmarkierung ein verschiebbares Gleitstück (118) umfaßt, das einen vorspringenden Abschnitt (118A) aufweist.

9. Batteriepack nach einem der Ansprüche 1 bis 8, der weiterhin mehrere Elektroden (36, 38) aufweist, die in dem genannten unteren Abschnitt des genannten Gehäuses für die elektrische Verbindung mit der genannten Batterie ausgeführt sind, wobei diese Elektroden als Ladeelektroden dienen, wenn der genannte Batteriepack mit einem Batterieladegerät verbunden ist, und die genannten Elektroden als Stromversorgungselektroden dienen, wenn der genannte Batteriepack mit einem elektrischen Gerät verbunden ist;
und bei dem die genannten Erfassungsöffnungen (102, 104) ein Mittel darstellen, um zu erkennen, wenn der genannte Pack korrekt in ein Batterieladegerät eingesetzt ist.

Revendications

1. Module d'accumulateurs (10) comportant un moyen d'accumulateurs qui y est logé, et adapté pour coopérer avec un chargeur d'accumulateur (12) ou avec un dispositif ou appareil électrique utilisant le module d'accumulateurs en tant que source d'alimentation, ledit module d'accumulateurs comprenant :

   un boîtier (14, 16) pour y loger ledit moyen d'accumulateurs ;
   un moyen d'ouverture de détection (102, 104) formé le long d'une ligne centrale (X-X) d'une surface de fond du boîtier, ladite surface de fond étant définie comme la surface au moyen de laquelle ledit module d'accumulateurs est en contact avec une partie de réception de module d'accumulateurs dudit chargeur d'accumulateur ou dudit dispositif ou appareil électrique, ledit moyen d'ouverture de détection étant adapté pour recevoir des parties en protubérance correspondantes formées sur ladite partie de réception de module d'accumulateurs.

2. Module d'accumulateurs (10) selon la revendication 1, comprenant en outre une partie évidée (106) formant une ouverture de détection supplémentaire au niveau d'une partie latérale dudit boîtier (14, 16), ladite ouverture de détection supplémentaire étant également adaptée pour recevoir une partie en protubérance correspondante formée sur ladite partie de réception de module d'accumulateurs dudit chargeur d'accumulateur ou dudit dispositif ou appareil électrique.

3. Module d'accumulateurs selon la revendication 1 ou 2, comprenant en outre une ouverture de verrouillage (108) formée de manière à être adjacente audit moyen d'ouverture de détection (102, 104) et présentant une dimension de largeur s'étendant suivant une direction perpendiculaire à ladite ligne centrale (X-X) et dans lequel ledit moyen d'ouverture de détection est plus petit que ladite ouverture de verrouillage.

4. Module d'accumulateurs selon l'une quelconque des revendications 1 à 3, dans lequel des accumulateurs en forme de colonnes sont logés selon deux rangées dans ledit boîtier (14, 16) et ledit moyen d'ouverture de détection (102, 104) est disposé entre les deux rangées d'accumulateurs le long de ladite ligne centrale (X-X) de ladite surface de fond.

5. Module d'accumulateurs selon l'une quelconque des revendications 1 à 4, comprenant en outre des éléments d'information (130, 132) disposés le long de ladite ligne centrale (X-X).

6. Module d'accumulateurs selon la revendication 5, dans lequel lesdits éléments d'information (130, 132) incluent un détecteur de température et un détecteur de tension pour détecter la capacité restante dudit accumulateur.

7. Module d'accumulateurs selon l'une quelconque des revendications 1 à 6, comprenant en outre un moyen de repérage d'identification (118A) disposé le long de ladite ligne centrale (X-X) de la surface de fond pour indiquer si oui ou non le module d'accumulateurs a été logé dans un appareil électrique adapté depuis qu'il a été inséré dans un chargeur d'accumulateur, pour ainsi produire une indication de si oui ou non ledit module d'accumulateurs est en cours d'utilisation depuis que l'accumulateur a été chargé.

8. Module d'accumulateurs selon la revendication 7, dans lequel ledit moyen de repérage d'identification inclut un coulisseau déplaçable (118) qui comporte une partie en protubérance (118A).

9. Module d'accumulateurs selon l'une quelconque des revendications 1 à 8, comprenant en outre une

pluralité d'électrodes (36, 38) formées dans ladite partie de fond dudit boîtier pour la connexion électrique avec ledit accumulateur, lesdites électrodes jouant le rôle d'électrodes de chargement lorsque ledit module d'accumulateurs est connecté à un chargeur d'accumulateur et lesdites électrodes jouant le rôle d'électrodes d'alimentation lorsque ledit module d'accumulateurs est connecté à un appareil électrique ; et dans lequel

ledit moyen d'ouverture de détection (102, 104) constitue un moyen permettant de détecter lorsque ledit module est positionné de manière appropriée dans un chargeur d'accumulateur.

FIG. 1 (PRIOR ART)

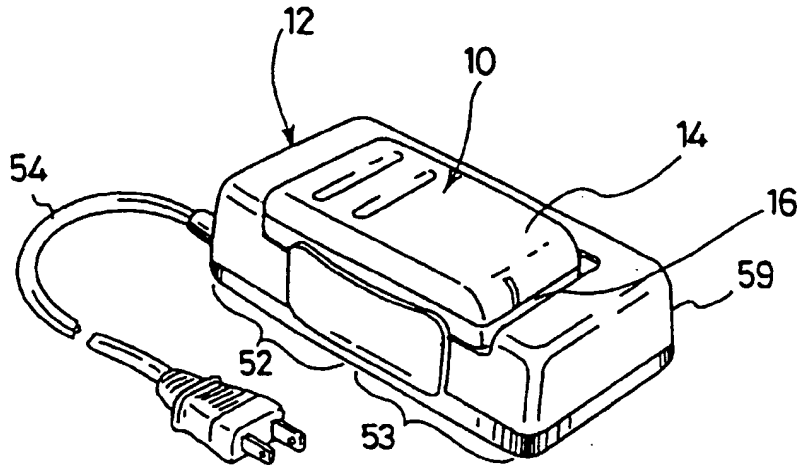


FIG. 2 (PRIOR ART)

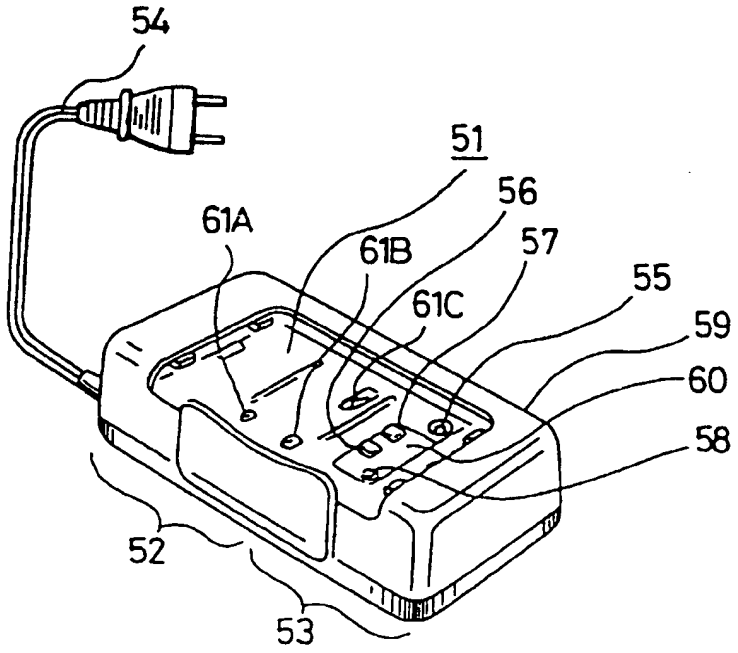


FIG. 3A (PRIOR ART)

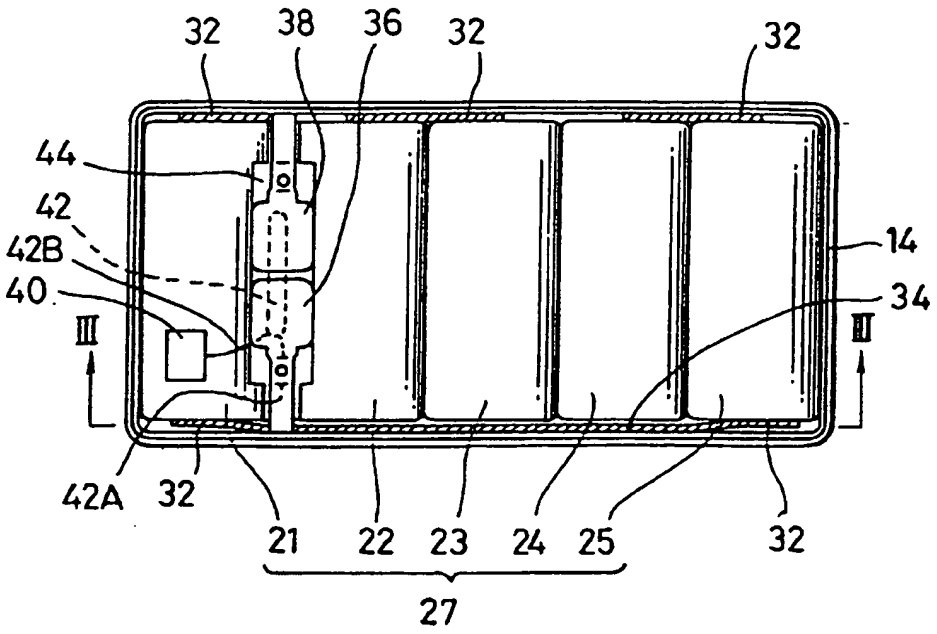
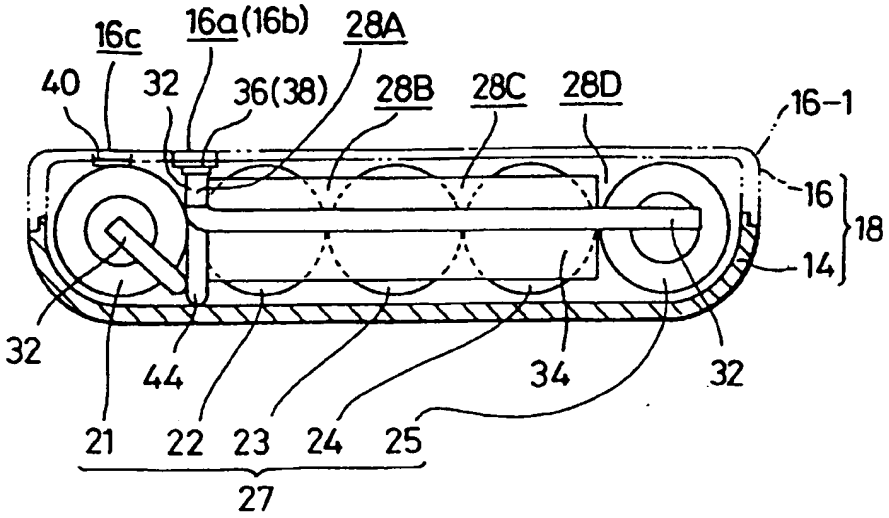


FIG. 3B (PRIOR ART)



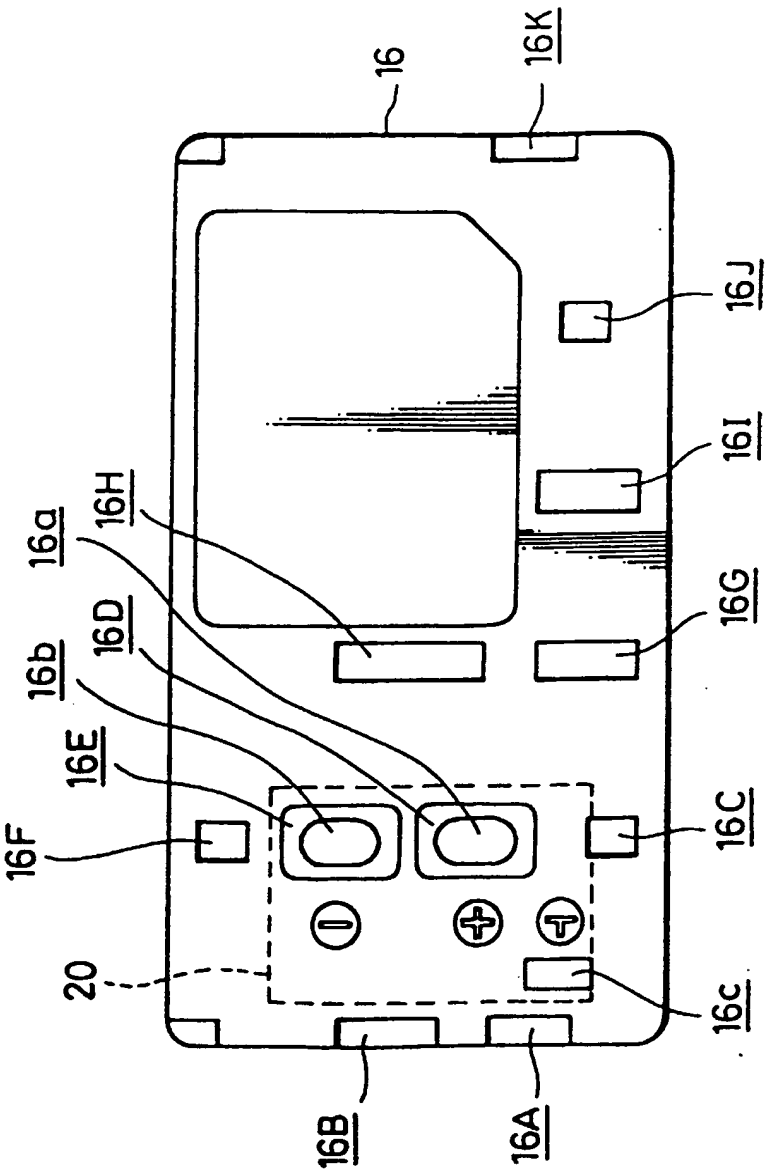


FIG. 4 (PRIOR ART)

FIG. 5A
(PRIOR ART)

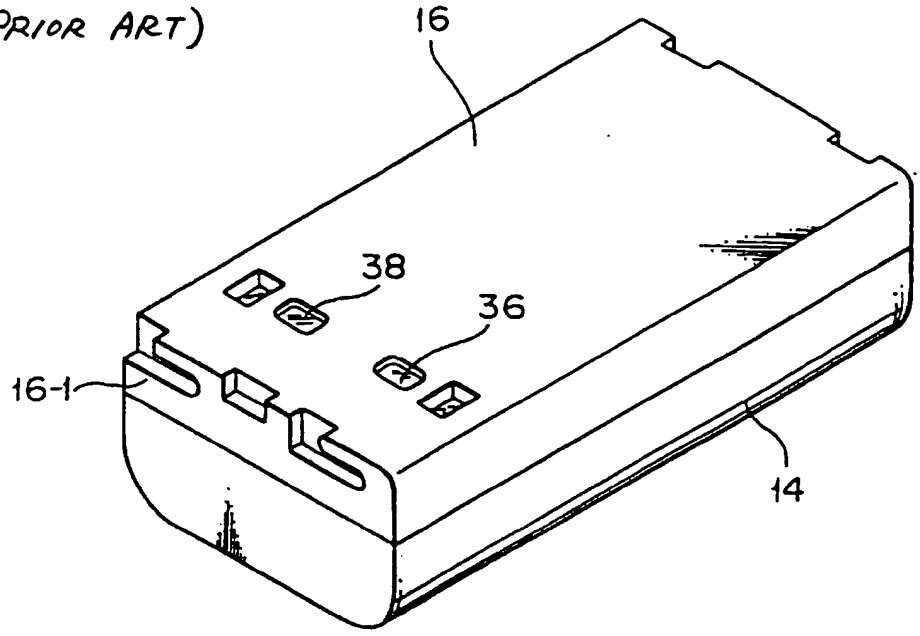


FIG. 5B
(PRIOR ART)

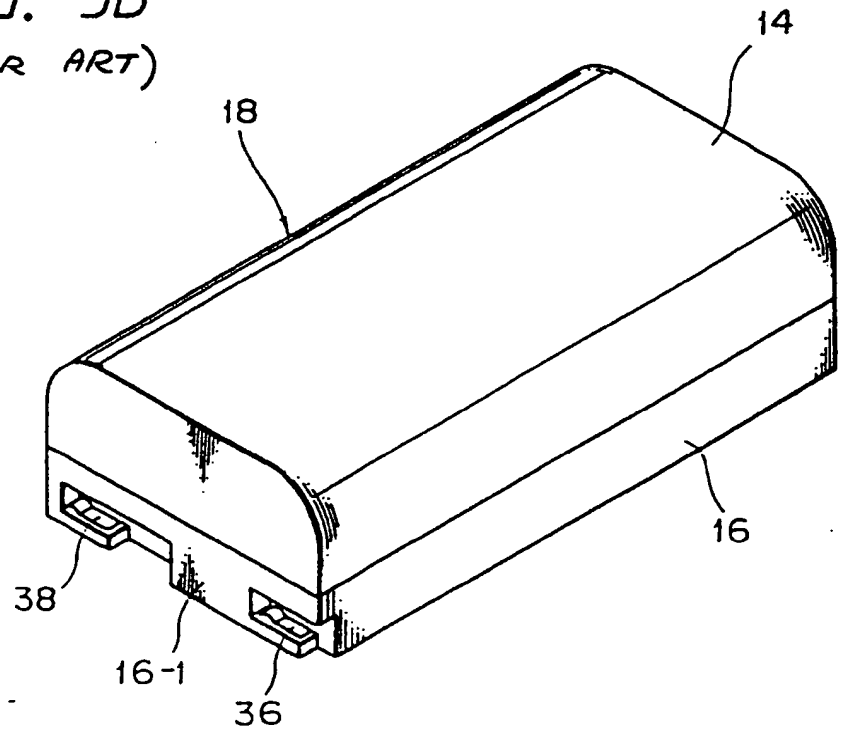


FIG. 6A
(PRIOR ART)

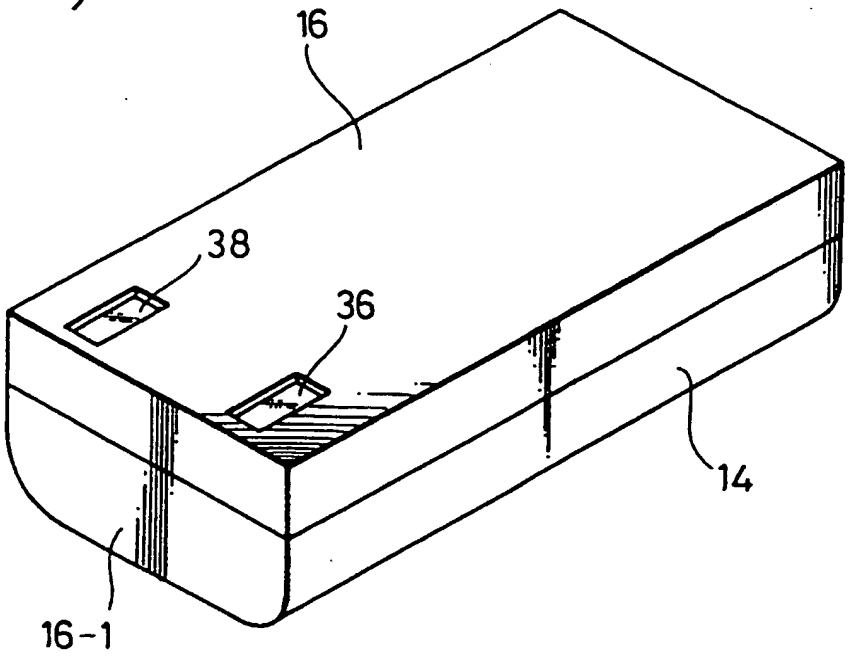
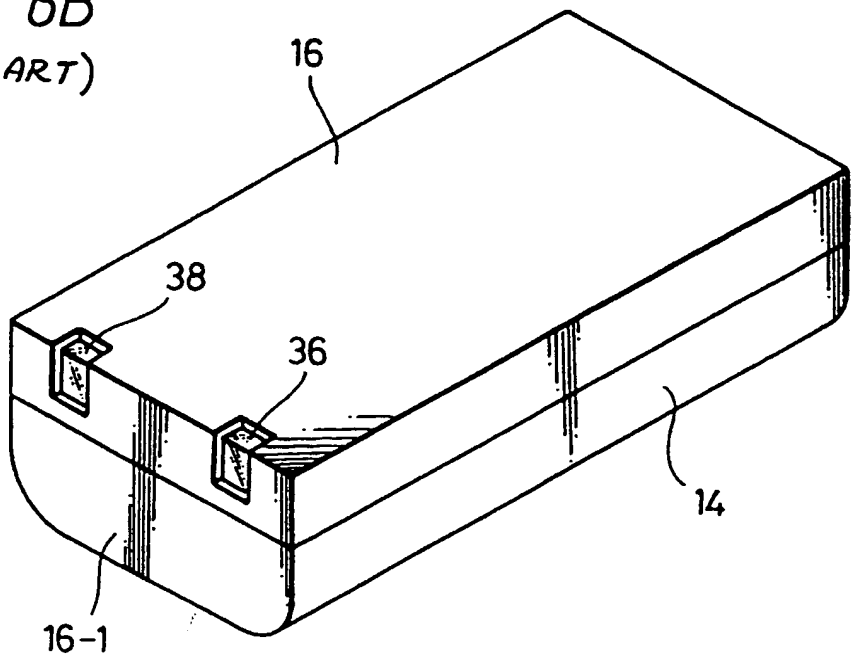


FIG. 6B
(PRIOR ART)



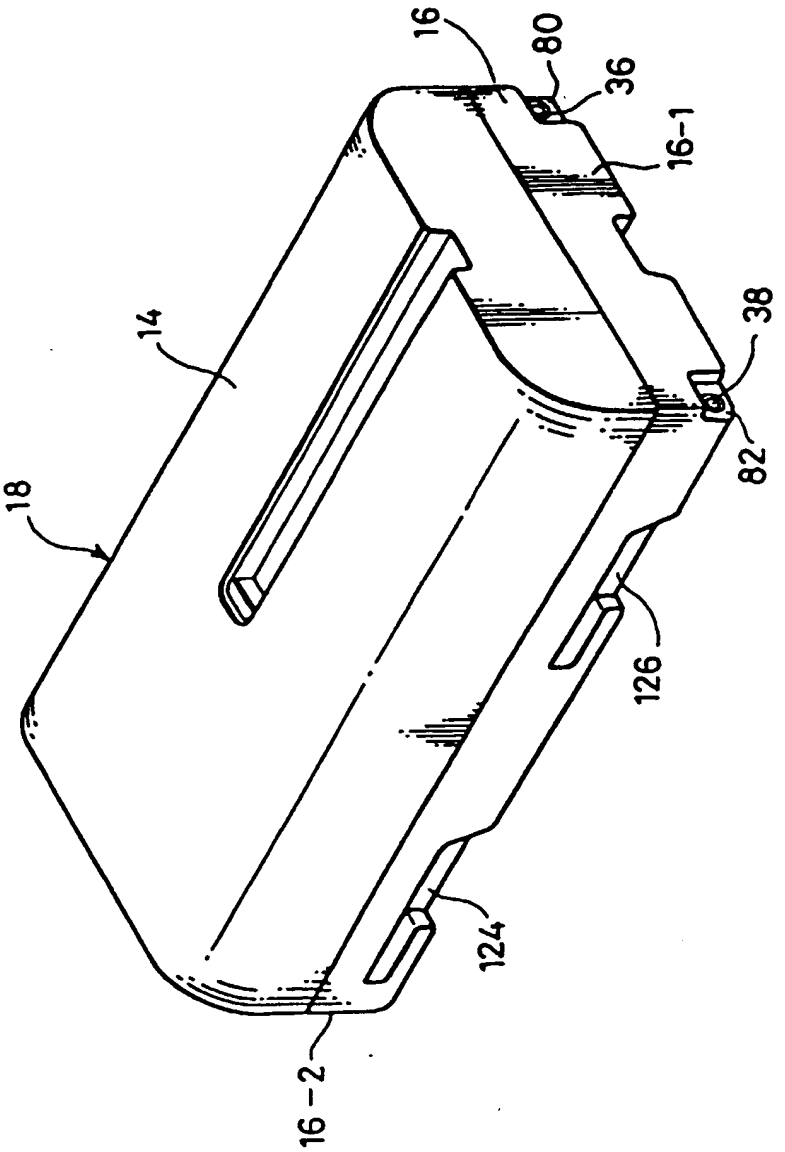


FIG. 7

FIG. 8A

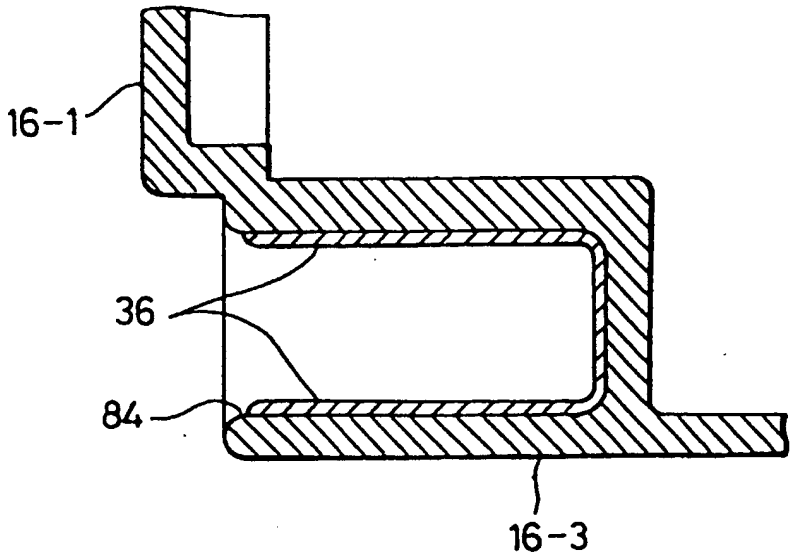


FIG. 8B

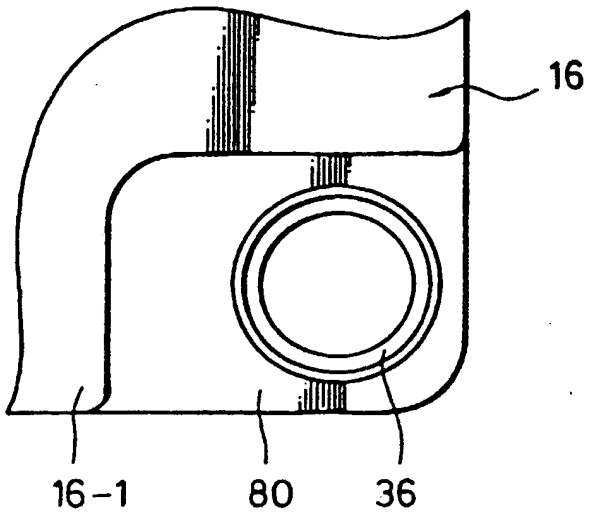


FIG. 9A

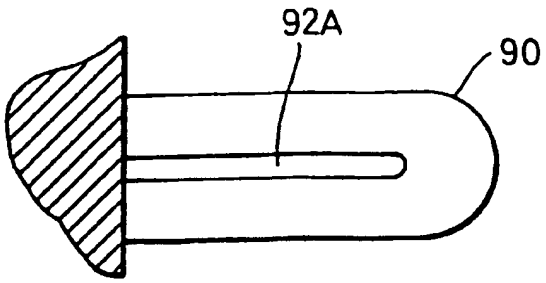


FIG. 9B

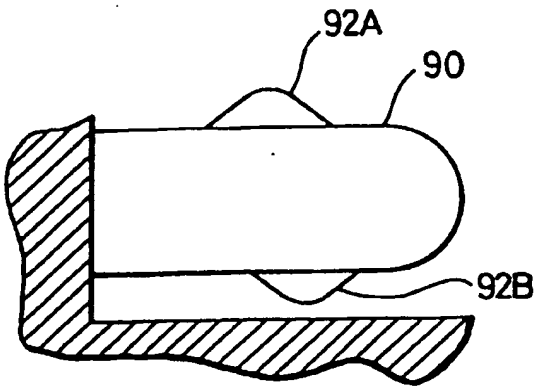
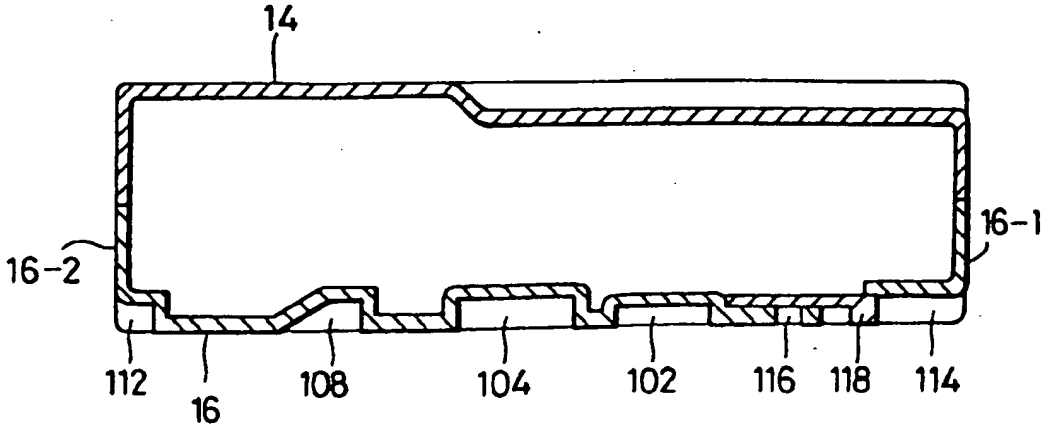


FIG. 12



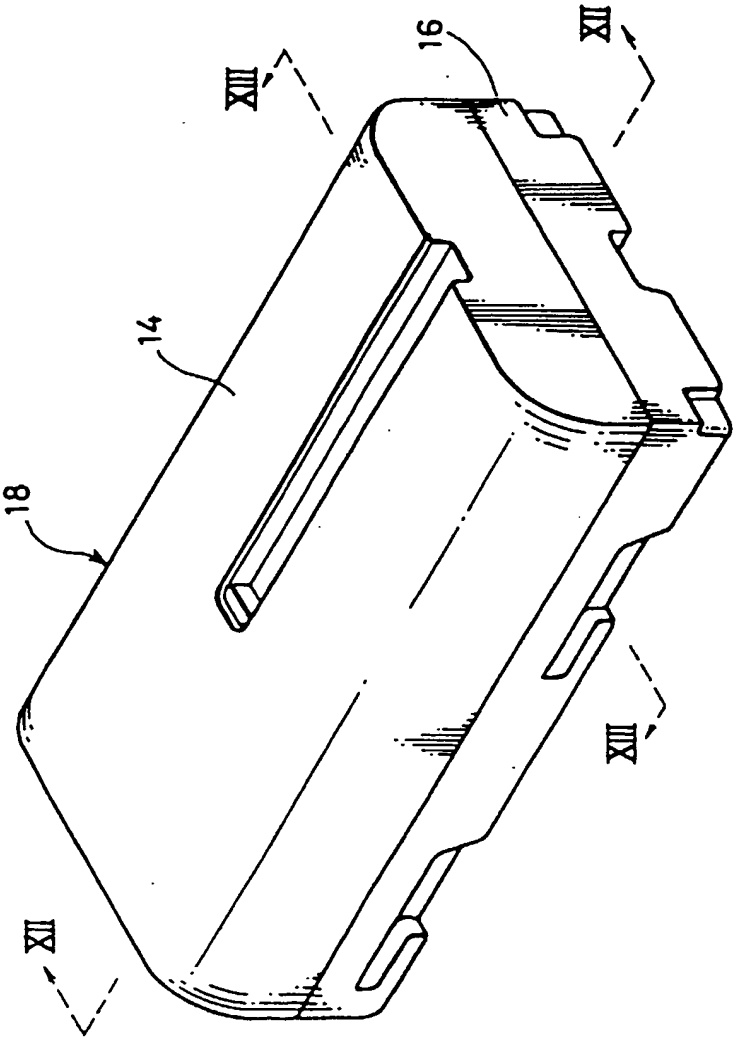


FIG. 10

FIG. 11A

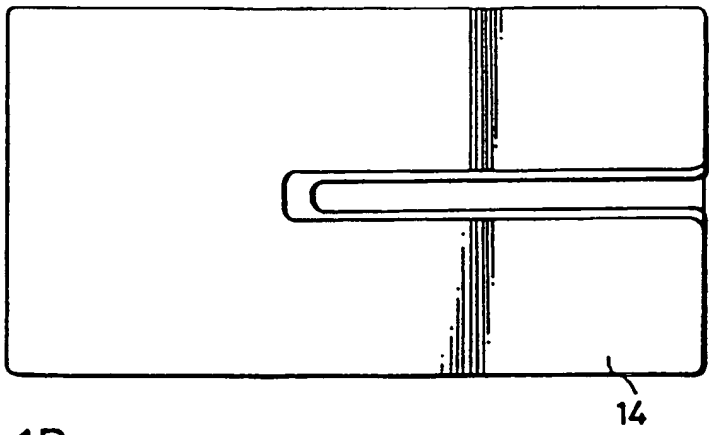


FIG. 11B

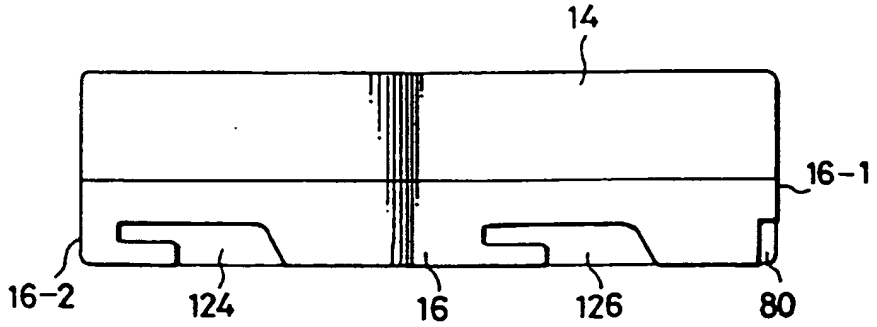


FIG. 11C

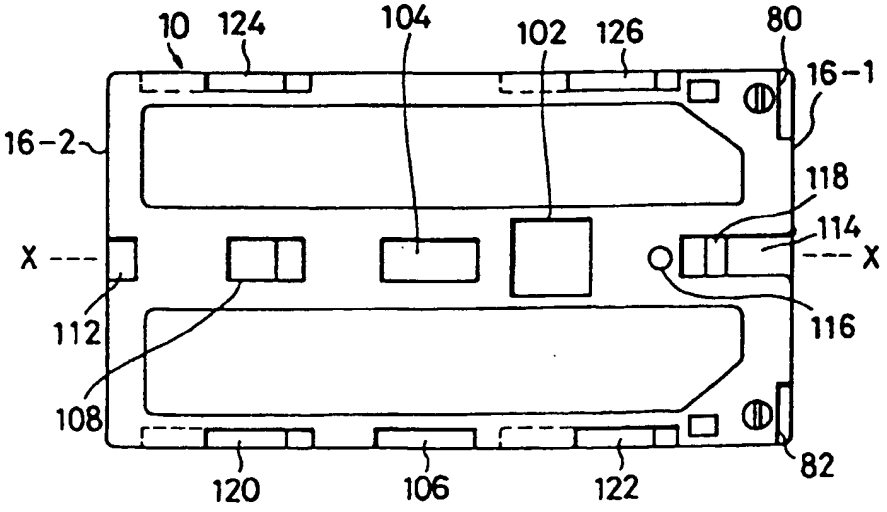


FIG. 13A

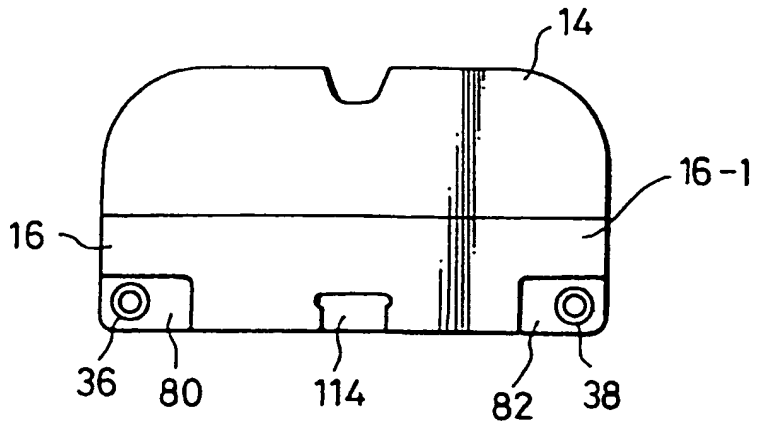


FIG. 13B

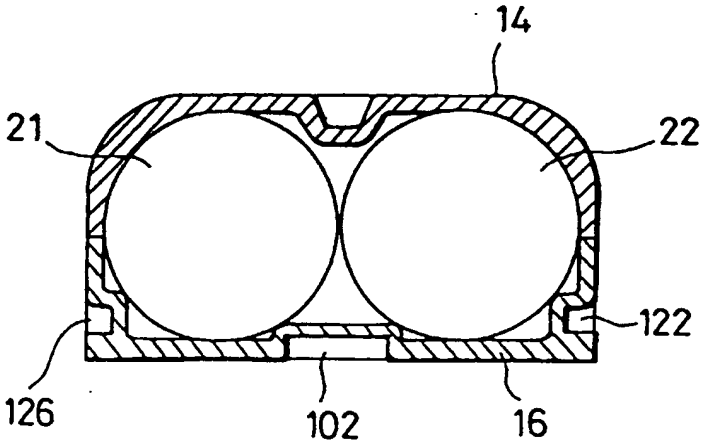


FIG. 14A

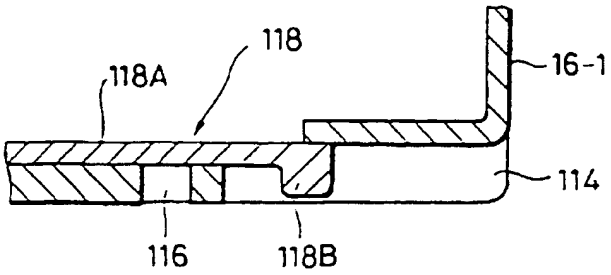


FIG. 14B

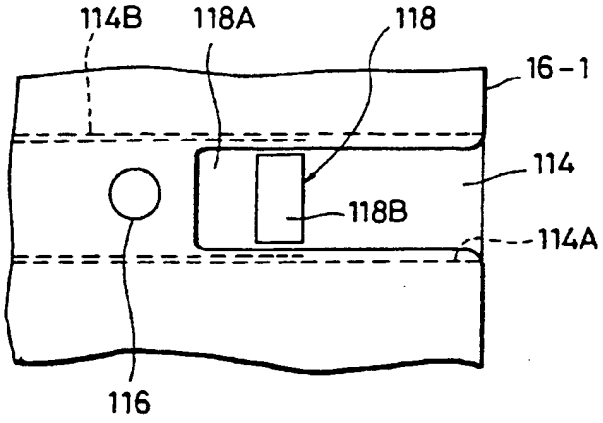


FIG. 16

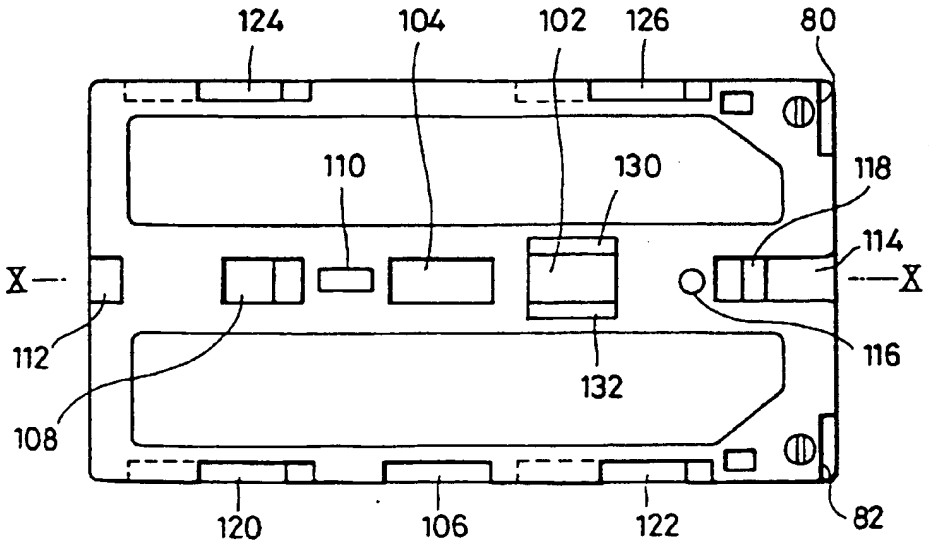


FIG. 15A

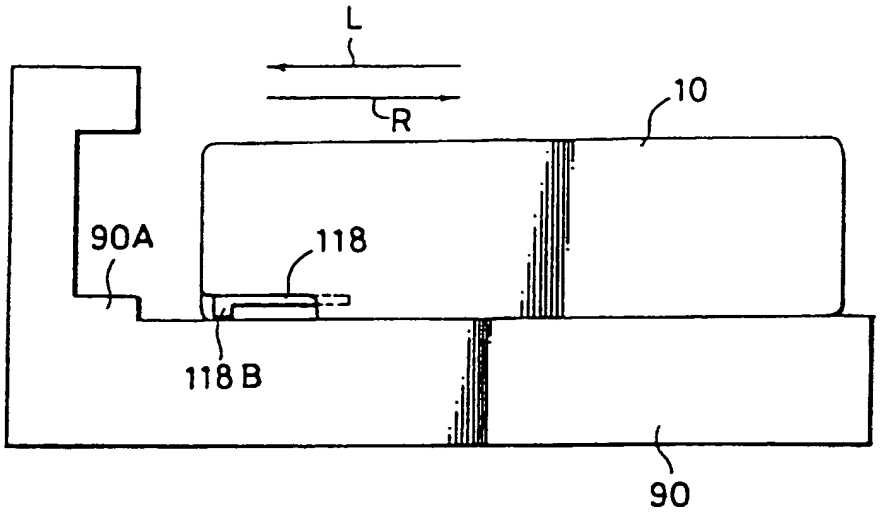


FIG. 15B

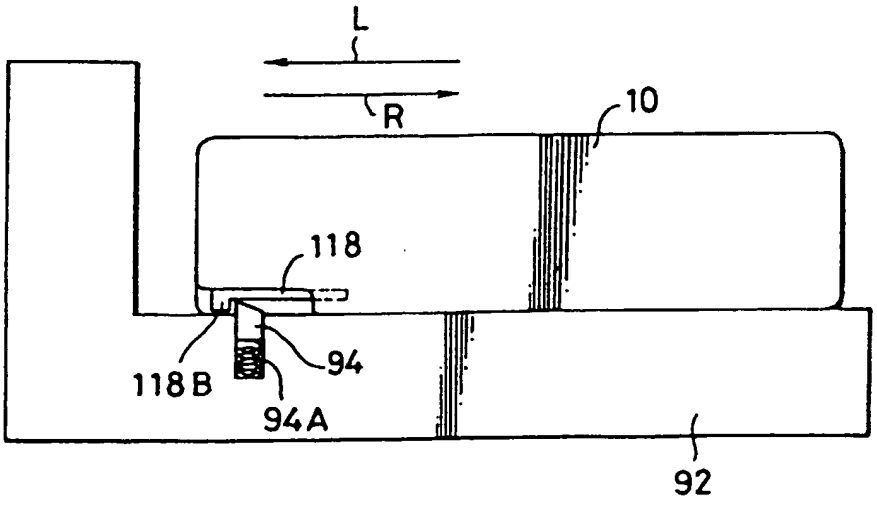


FIG. 17A

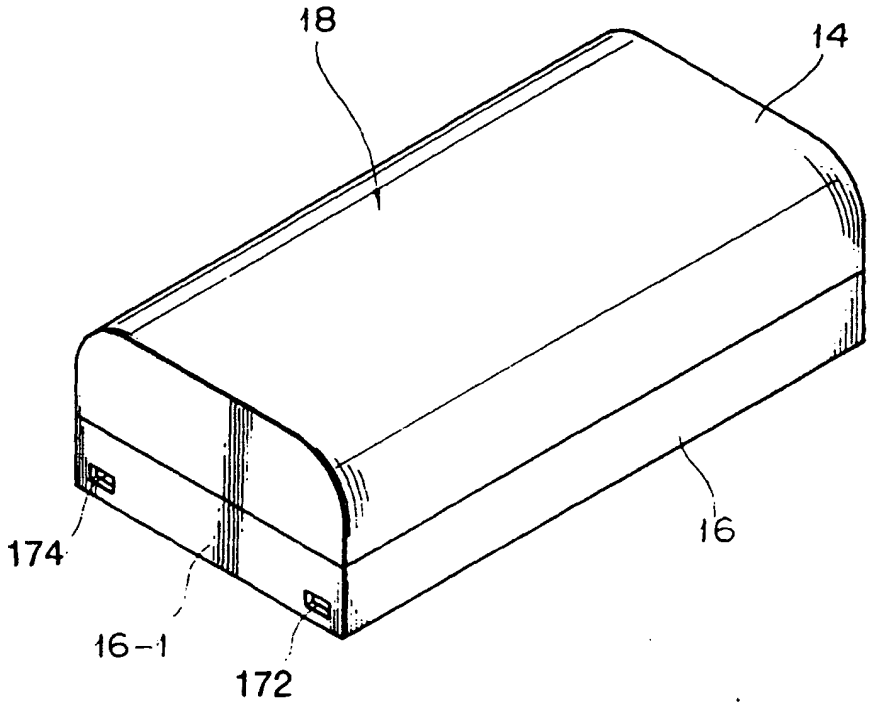


FIG. 17B

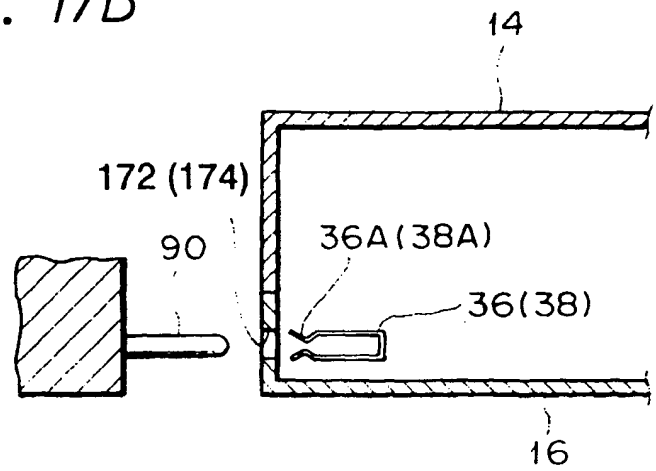


FIG. 18A

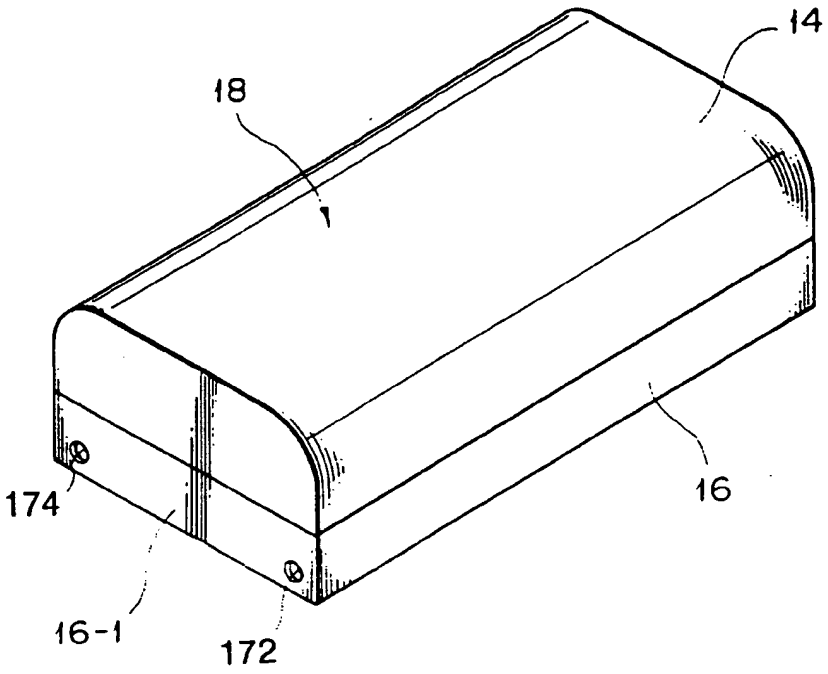


FIG. 18B

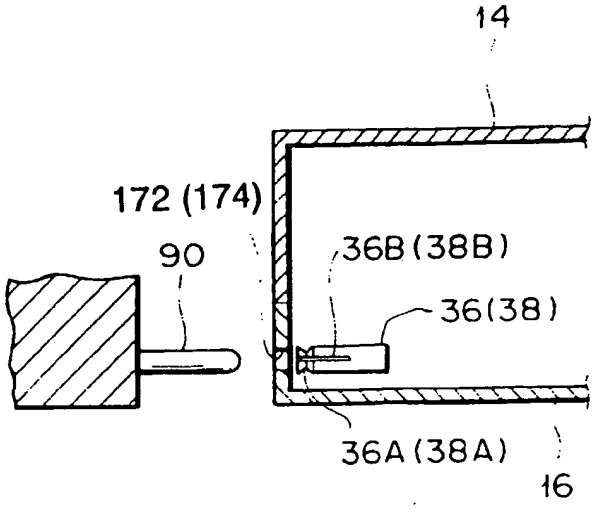


FIG. 19A

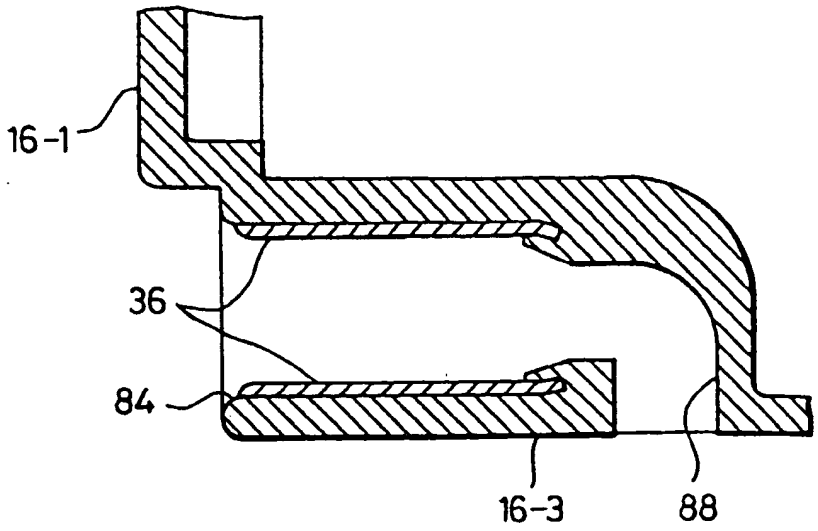


FIG. 19B

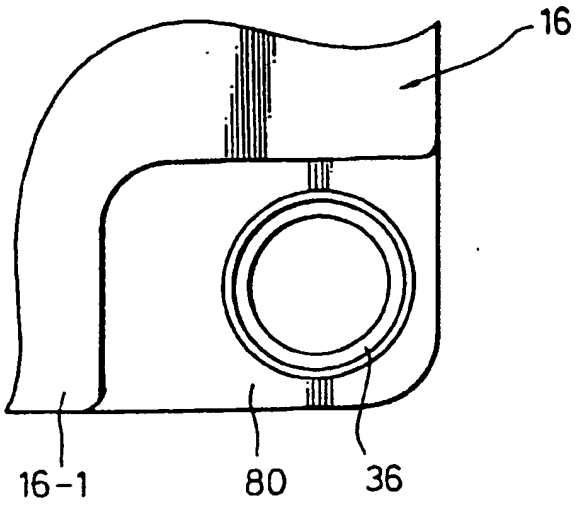


FIG. 20A

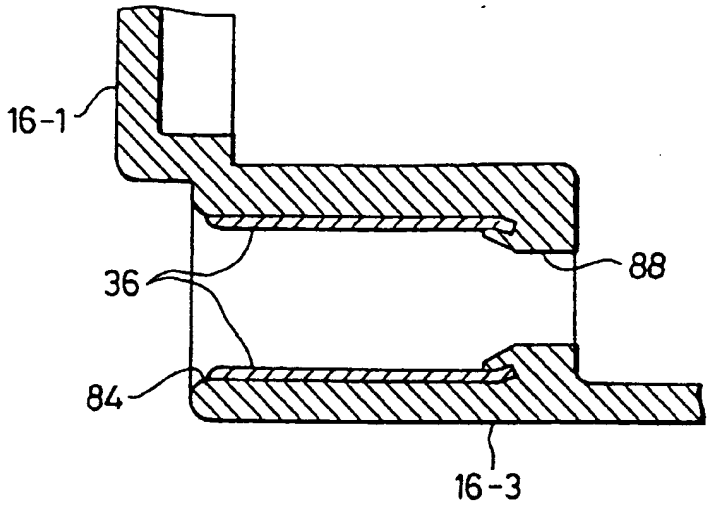


FIG. 20B